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Effect of the Hospital Elder Life Program on the Risk of 30-day Readmissions

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Conflict of Interest Checklist:

Elements of Financial/ Personal Conflicts	Rubin		Bellon		Bilderback		Urda		Inouye	
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Employment or affiliation		X		X		X		X		x
Grants/funds		X		X		X		X		X
Honoraria		X		X		X		X		X
Speaker forum		X		X		X		X		X
Consultant		X		X		X		X		X
Stocks		X		X		X		X		X
Royalties		X		X		X		X		X
Expert testimony		X		X		X		X		X
Board member		X		X		X		X		X
Patents		X		X		X		X		X
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Abstract

OBJECTIVES—To compare rates of 30-day readmissions between hospital units with a Hospital Elder Life Program (HELP) compared to Control units without HELP.

DESIGN—Retrospective cohort study

SETTING—The study took place from July 1, 2013 to June 30, 2014 at the University of Pittsburgh Medical Center Shadyside, a 520-bed community teaching hospital that has utilized HELP since 2002. Eight medical/surgical units with HELP were compared to ten medical/surgical units without HELP.

PARTICIPANTS—During the study period, HELP units had 4,794 patients over 70 years of age while usual care units had 2,834 patients.

INTERVENTION—HELP is a multifactorial, multidisciplinary program that provides targeted interventions for delirium risk factors in at-risk patients, in collaboration with bedside staff.

MEASUREMENTS—Mixed-effects Poisson regression models were used to estimate the adjusted incident risk ratio for 30-day readmissions between HELP and usual care units for the overall cohort and for the subgroup of patients discharged to home or home with services.

RESULTS—Patients in HELP units were more likely than usual care units to be older, female, and black, and had an unadjusted readmission rate of 16.9%, versus 18.9% for patients on Control units. The adjusted risk of readmission for HELP unit patients overall is 0.83 (95% Confidence Interval (CI) = 0.73–0.94, $p=0.003$) and for HELP unit patients discharged to home or home with services is 0.74 (95% CI = 0.63–0.87, $p<0.001$).

CONCLUSION—The HELP program is associated with lower risk of 30-day hospital readmissions overall and for the subgroup discharged to home. Prospective studies are needed to confirm these observations.

Keywords

Hospital Elder Life Program; readmissions; delirium prevention; quality improvement; acute care for elderly

Introduction

Delirium is a highly prevalent acute neuropsychiatric condition, occurring at high rates in older hospitalized adults. Significant variability exists between patient types, but studies show that the prevalence at admission can range from 18 to 50%, and incidence while hospitalized can be 11 to 82%.¹ These prevalence and incidence rates suggest that delirium affects millions of hospitalized elderly patients every year.² While delirium is an acute condition, it has lasting effects with fully a third of patients on medicine units experiencing persistent symptoms following delirium.³ Surgical patients have been shown to have reduced physical function for over 30 days and cognitive impairment for up to a year due to the

effects of delirium.¹ Patients with delirium also have higher rates of subsequent dementia, institutionalization, mortality, and healthcare costs after discharge compared to patients without delirium.^{1, 4, 5}

One of the factors likely contributing to the poorer long-term outcomes and higher costs associated with delirium is increased hospital readmissions.^{6, 7} Hospitals in the United States are being increasingly incentivized to reduce unplanned readmissions for Medicare patients.^{8, 9} The Hospital Readmissions Reduction Program, introduced in 2012 as part of the Affordable Care Act (ACA), reduces Medicare payments to hospitals with excess readmissions for a growing list of conditions.¹⁰ Delirium is common among the Medicare population and can increase readmissions among all patient types due to its complications and long-term effects. Failing to identify, prevent, and treat delirium can have negative consequences for patients' health and potentially for the quality ratings and finances of hospitals treating those patients.

Studies suggest that readmission rates are primarily determined by patient characteristics with social and functional characteristics playing a critical explanatory role.^{9, 13} Patient characteristics include the primary diagnosis with higher readmissions rates among patients hospitalized for cancer treatment, heart failure, chronic obstructive pulmonary disease, renal failure, and septicemia.¹⁴ Other predictive variables are age, race, income, education level, presence of co-morbid conditions, social connectedness, disabilities, difficulties with activities of daily living, cognition, and functional status.^{14, 15} A meta-analysis found that intervention characteristics associated with reductions in 30-day readmissions include "bundled" interventions that increase patients' capacity for self-care, involve two or more individuals in delivery, and include at least five unique component activities.¹⁶ These predictive variables and findings from interventions to reduce readmissions suggest that attention to the "whole person" is a critical component of patient health and reducing hospitalization.

Delirium is a multifactorial condition requiring a multicomponent, multidisciplinary approach. Patients who develop delirium tend to be older, with dementia, high illness severity, and multiple comorbid conditions. These patient characteristics are consistent with the clinical characteristics also shown to increase readmissions. Certain medications, anesthesia, infections, reduced activity, catheterization, and malnutrition can also contribute to delirium incidence.^{1, 17} Furthermore, delirium includes fluctuations in cognition and consciousness, making monitoring and treatment, challenging. Recent systematic reviews found that multicomponent hospital-based programs have been effective in preventing delirium in at-risk patients.^{18, 19} The Hospital Elder Life Program (HELP) is the original evidence-based program that formed the basis for subsequent programs and is cost-effective for preventing incident delirium in patients at moderate risk of delirium.^{20–22}

HELP, which was developed in 1993 and has been disseminated across the United States and internationally, has been described in previous publications.^{20, 23} In brief, it is a program that assesses older patients for risk of delirium and coordinates care for at-risk patients with a core multidisciplinary team, comprised of an Elder Life Specialist, Elder Life Nurse Specialist, geriatrician, and trained volunteers. This team utilizes multiple strategies to

address the modifiable risk factors that can contribute to delirium, such as mobilization, orientation, sensory adaptation, social interaction, nonpharmacologic approaches to sleep and anxiety, and assistance with meals and hydration. These modifiable risk factors are also key drivers for readmissions. While HELP has been shown to decrease length of stay (LOS) and reduce costs of hospitalization and post-acute care, there is a lack of published studies addressing its effect on readmissions. The hypothesis of this study is that patients receiving HELP will have lower rates of readmission relative to control patients because the bundle of HELP interventions has been previously shown to reduce delirium incidence, address cognitive and functional decline, and increase self-care capacity. This study examines the rate of 30 day readmissions between inpatient nursing units with a well-established HELP program compared to units without HELP in a large community hospital.

Methods

Setting and Participants

The University of Pittsburgh Medical Center (UPMC) Shadyside Hospital is a 520-bed community teaching hospital that has been utilizing HELP for at-risk geriatric patients since 2002. Shadyside HELP is a mature, established HELP program with high fidelity and program adherence that has previously been described.^{21, 22} During the study period from July 1, 2013 to June 30, 2014, the program was active on eight units of the hospital. The remaining 10 units in the hospital were used as control units. Both contain units with teaching and non-teaching services as well as medical and surgical services. Four of the control units are cancer specialty units. Patients are selected for the HELP program per established criteria: 70 years of age or older, at least one risk factor for cognitive or functional decline, and ability to communicate. Patients with mechanical ventilation, combative behavior, severe dementia, expected discharge within 48 hours, or refusal are excluded.²¹ During the study period, 4,794 patients were treated by HELP while 2,834 patients over 70 were treated on the control units with usual care.

Study and Outcome Variables

To compare patients on HELP units with control units, we obtained demographic data on patients' age, race, gender, and admitting service. To assess illness severity and comorbidity, we examined three measures, including All Patient Refined Diagnosis Related Group (APR-DRG) weight,²⁴ the Deyo-Charlson comorbidity index²⁵ and the Elixhauser comorbidity index.²⁶ The APR-DRG utilizes primary and secondary diagnoses, age, and surgical procedures to assign a weight based on clinical complexity and severity of illness. The Deyo-Charlson is a count of 22 comorbid conditions while the Elixhauser is a count of 31 comorbid conditions, and both predict one-year mortality. All three measures are accepted models of risk adjustment and provide useful comparison. We also analyzed several outcome variables, including LOS, and 30-day post-discharge mortality. Discharge disposition was categorized as home or home with services, rehabilitation facility, skilled nursing facility, hospice, and other (e.g., assisted living). The main outcome was hospital readmissions, defined as any inpatient readmission to UPMC within 30 days of the index admission. We excluded readmissions for index admissions occurring before the study period, index admissions resulting in an in-hospital mortality, and planned readmissions, including

chemotherapy. As a secondary analysis, we examined readmissions for patients discharged to home or home with services, given that their readmission patterns may differ from patients in post-acute facilities. All data was retrieved from UPMC's hospital administrative data system. The HELP program has received exempt status from the UPMC IRB for research involving deidentified administrative data.

Statistical Analysis

We utilized a bivariate analysis to compare demographics and unadjusted outcomes for patients in HELP units to control units. Next we used two mixed-effects Poisson regression models to account for patient differences and estimate the effect of HELP and other variables on inpatient readmission within 30 days, presented as adjusted risk of readmission. The first model included all patients in the cohort, and the second model included only patients discharged to home or home with services. The Poisson regression model was chosen to estimate the readmissions adjusted incident risk ratio (IRR) between HELP and control units, which allows for more interpretable results than an odds ratio. The models were constructed with robust standard errors and random-effects to account for patient level clustering.²⁷ They were adjusted for age, race, comorbidity indices, log-transformed APR-DRG weight, service group, and LOS. There was no missing data for major outcomes; however, 124 (1.6%) records were missing the control variables for age and LOS. Records with missing data were not included in the final models and tests of missing data indicate no impact on results. All statistical modeling used Stata version 14.2 (StataCorp, College Station, TX).

Results

Comparisons of patient demographics are presented in Table 1. This analysis shows that patients in HELP units were significantly older by 2 years on average, more often female and black. HELP patients had fewer comorbidities by the Deyo-Charlson index and more comorbidities by the Elixhauser index. Deyo-Charlson weights cancer more heavily than Elixhauser, and the four control cancer specialty units contributed to this discrepancy. The APR-DRG weights were similar between HELP and control units. The proportion of surgical patients was not statistically different between the two groups. Reflecting their older age, the unadjusted outcomes in Table 2 show that patients in HELP units had a statistically longer LOS, were more likely to be discharged to a skilled nursing or rehabilitation facility, and were less likely to be discharged to home than control patients. Overall, Table 3 shows that HELP patients had significantly lower unadjusted readmission rates (16.9% vs. 18.9%, $P < .02$).

To determine if the adjusted risk of readmission for HELP units was significantly different compared to control units, we considered the overall population first and then considered the cohort of patients discharged to home with or without services. We then modeled the adjusted risk of readmission using the Deyo-Charlson index in Model 1 and the Elixhauser index in Model 2 to account for the differences observed in the bivariate analyses. We also controlled for age, race, log-transformed APR-DRG weight, service group, and LOS in both models. In adjusted multivariable analysis using Deyo-Charlson (Model 1, Table 3), HELP

patients overall did demonstrate a trend towards reduced readmissions, which was not statistically significant (IRR=0.92, 95% CI=0.81–1.04, p=0.164). For patients discharged to home with or without services, (Model 2, Table 3) the adjusted risk of readmission for HELP patients was 0.83 (95% CI=0.70–0.97, p=0.019), suggesting that the risk of readmissions is 17.5% lower for this subgroup of HELP patients. In adjusted multivariable analysis using Elixhauser (Model 2, Table 3), the adjusted risk of readmission for HELP patients was 0.83 (95% CI=0.73–0.94, p=0.003) for the overall population and 0.74 (95% CI= 0.63–0.87, p<0.001) for patients discharged to home with or without services, suggesting that the risk of readmissions is 17.2% lower for the HELP overall population and 26.3% lower for HELP patients discharged to home with or without services. As a sensitivity analysis to address the impact of cancer diagnoses on the findings, we excluded patients with cancer diagnoses from all units and repeated the analyses. We continued to see the same trends among HELP versus Control units across our models (IRR 0.94–0.98 overall; 0.85–0.88 for discharged to home), although none of these results achieved statistical significance. The difference in readmission rates in the overall HELP group compared with control units (16.9% versus 18.9%) translated into approximately 100 readmissions that were prevented on HELP units for one year.

Discussion

While HELP has its roots in preventing and treating delirium, it is a multicomponent intervention for older adults with a “whole person” approach to care. It aims to reduce the rate of delirium as well as rates of cognitive and functional decline. Previous studies have shown that HELP can reduce hospital costs, including LOS and costs of care. This study shows that the intervention is also associated with reduced readmissions. We have demonstrated a relative reduction of 17.2% in readmission rate between HELP and control units and 17.5% to 26.3% for HELP patients discharged to home with or without services. We observed differences in the rates of readmission depending upon which comorbidity index was used, as shown in Table 3. The Deyo-Charlson applies a higher level of risk to control units with more patients with cancer than the Elixhauser, resulting in a lower effect on readmissions (IRR [95% CI] = .92 [.81,1.04] versus .83 [.73,.94]). The trends are directionally the same, but the models differ in statistical significance. Overall, the differences in readmission rates translate into 100 fewer readmissions due to HELP during the one-year study period at our hospital. A 2% reduction in the Medicare readmission rate would extrapolate nationally to 40,000 less readmissions per year with potential cost savings of approximately \$491 million per year.²⁸ Notably, our results also lend support for the prior meta-analysis that showed that multi-component interventions focused on the patient can improve rates of readmission.¹⁶

While excellence in clinical subspecialties is important, Medicare and other payer programs focused on reducing readmissions and assessing hospital-wide quality place greater importance on holistic treatment of patients, improved transitions of care, and greater connection with post-acute settings. These foci have been shown to reduce costs for Medicare while maintaining or improving the quality of care and population health outcomes.²⁹ Hospitals are under financial pressure to implement and enhance programs that increase patient self-care, functional status, and coordination post-discharge. In our

experience, hospitals have many successful programs to address individual segments of patient care, but the coordination between these services through a comprehensive program like HELP is critical for success.

A limitation of the current study is that it is a retrospective study conducted in one hospital. The study has a large sample size, which allows significant power for our results, but generalizability to other settings is limited. This study included all admissions and did not restrict the population to those with delirium or known risk factors for delirium. Data on delirium incidence, severity, and duration were not available for the control group. The study groups were not comparable at baseline, and the results suggest that higher risk patients may have been preferentially admitted to HELP units. Moreover, many HELP program interventions are unit wide on HELP units, but only patients enrolled in HELP received the full complement of HELP intervention protocols. While this pragmatic study controlled for age, race, comorbidity, and LOS, we were unable to control for other potential delirium risk factors, which were not present in our administrative data. Patients included in the study also represent a variety of diagnoses that can affect outcomes. We did not control for specific diagnosis related groups, but did note that the APR-DRG weight between groups was not significantly different. Furthermore, our readmission results account for age and are adjusted for patient characteristics and co-morbid conditions, using both the Deyo-Charlson and Elixhauser indices. Another important limitation is that we were unable to ascertain readmissions that may have occurred outside of the UPMC system; however, given UPMC's dominance in the local region, this was unlikely to have had major impact on the results.

Dissemination of the HELP model has been challenging.³⁰ The increasing financial pressures to better manage patients in the hospital and during their transition home are forcing hospitals and providers to think differently about how they care for patients, particularly Medicare patients. HELP is an evidence-based program that can help hospitals pivot to a more holistic model of care, which has been proven to decrease costs and readmissions.

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Table 1

Characteristics of patients in Hospital Elder Life Program (HELP) units compared to control units

	HELP, n=4,794	Control, n=2,834	p
Age, mean (Standard Deviation (SD))	80.4 (7.0)	78.4 (6.5)	<.001
Female, n (%)	2,748 (57.3%)	1,458 (51.4%)	<.001
Race, n (%)			
Black	880 (18.4%)	354 (12.5%)	<.001
White	3,792 (79.1%)	2,353 (83.0%)	<.001
Other ¹	122 (2.5%)	127 (4.5%)	<.001
Deyo-Charlson ^{index}	2.7 (2.4)	3.2 (2.8)	<.001
Elixhauser index, mean (SD)	4.9 (2.5)	4.3 (2.4)	<.001
APR-DRG-based Severity of Illness, n(%) ²			<.001
Minor	525 (11.0%)	436 (15.4%)	
Moderate	1590 (33.2%)	1048 (37.0%)	
Major	2082 (43.4%)	1095 (38.6%)	
Extreme	596 (12.4%)	255 (9.0%)	
APR-DRG weight, geometric mean [95% Confidence Interval]	9.1 [8.8,9.5]	8.9 [8.5,9.3]	0.705
Service group, n (%)			
Family medicine	587 (14.3%)	184 (6.5%)	<.001
Medicine	2,559 (53.4%)	1,697 (59.9%)	<.001
Surgery	1,548 (32.3%)	953 (33.6%)	0.230

¹Other is about 85% 'not specified' and 6% 'declined'. The remainder is a mix of Asian & Pacific Islander categories.

²APR-DRG is the All Patient Refined Diagnosis Related Group.

Table 2

Outcomes of patients in Hospital Elder Life Program (HELP) units compared to non-HELP units

	HELP, n=4,794	Control, n=2,834	p
Length of stay, median [interquartile range]	4 [3,7]	4 [2,6]	<.001
30 day post-discharge mortality, n(%)	228 (4.8%)	161 (5.7%)	0.078
Discharge disposition, n(%)			
Home	1,517 (31.6%)	1,308 (46.2%)	<.001
Home with services	1,325 (27.6%)	785 (27.7%)	.954
Rehabilitation facility	278 (5.8%)	69 (2.4%)	<.001
Skilled nursing facility	1,514 (31.6%)	565 (19.9%)	<.001
Hospice	79 (1.6%)	67 (2.4%)	0.029
Other ^I	81 (1.7%)	40 (1.4%)	0.343

^IOther is 56% Independent Care Facility/Assisted Living Facility, 27% long term hospital.

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Table 3
Readmission Outcomes in Hospital Elder Life Program (HELP) units compared to control units

Variable	Overall N=7,628		Discharged to home with or without services N=4,935		P
	HELP N=4,794	Control N=2834	HELP N=2,842	Control N=2,093	
Unadjusted readmission of those discharged alive, n (%)	808 (16.9%)	537 (18.9%)	421 (14.8%)	405 (19.4%)	<.001
Number of readmissions, n (%)					<.001
0	3,986 (83.2%)	2,297 (81.1%)	2,421 (85.2%)	1,688 (80.7%)	
1	650 (13.6%)	448 (15.8%)	331 (11.7%)	329 (15.7%)	
2	133 (2.8%)	77 (2.7%)	74 (2.6%)	67 (3.2%)	
3+	25 (0.5%)	12 (0.4%)	16 (0.6%)	9 (0.4%)	
Model 1: Risk of readmission/Charlson, IRR [95% CI] ¹	.92 [.81,1.04]	(referent)	.83 [.70,.97]	(referent)	.019
Model 2: Risk of readmission/Elixhauser, IRR [95% CI] ²	.83 [.73,.94]	(referent)	.74 [.63,.87]	(referent)	<.001

¹ Results are Incidence Rate Ratios (IRR) displayed with Confidence Intervals (CI) for unplanned 30-day readmission. Models adjusted for Deyo-Charlson index, age, race, ln(APR DRG weight), service group and length of stay.

² Results are Incidence Rate Ratios for unplanned 30-day readmission. Models adjusted for Elixhauser index, age, race, ln(APR DRG weight), service group and length of stay.